INTEGRACION ELECTRICA DE CENTROAMERICA

Documento preparado por el Ing. Kenneth E. Sorensen para la Primera Reunión del Sub-Comité Centroamericano de Electrificación que se verificará en San Salvador, bajo los auspicios de la CEPAL.

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ELECTRICAL INTEGRATION OF CENTRAL AMERICA

An interconnected transmission grid extending from Guatemala City to San Jose will probably be realized in the future. The total distance of 990 kilometers is less than the length of existing grids in Europe and the United States. Although power demands within Central America today are not large enough to justify the investment in transmission line at present, the very rapid increase in electric power use may justify the grid within the next 20 to 30 years. Certain portions of the ultimate grid, interconnecting two or more countries, will be economically justified much sooner.

Principal load centers of each country are the capital cities. Examination of a map shows airline distances between the load centers to be as follows:

Guatemala to San Salvador,	178 Km
San Salvador to Tegucigalpa,	220 Km
Tegucigalpa to Managua,	251 Km
Managua to San Jose,	341 Km

The distances between those neighboring capitals are comparable and none are outside the range of transmission feasibility.

Locations of the existing hydroelectric plants and potential plants in Central America show even more favorable transmission distances in some areas. For example: the Upper Rio Lempa projects in El Salvador are 137 Km from Guatemala City; the Guayabo Project and lower

delivered and received is balanced. Energy interchange can be off-peak, with installed capacities in each country sufficient only for each country's own peak demands. This form of interchange will be possible where one country has run-of-river projects with surplus wet season energy and the other country has sizeable thermal generation, or has hydroelectric plants with complete river regulation.

One example of this integration might exist between El Salvador and Guatemala. The Río Lempa plants will have surplus energy in the wet season which could be transmitted to Guatemala for reducing fuel consumption in the wet season. During the dry season, thermal energy from Guatemala could be transmitted to El Salvador, to firm up the Rio Lempa hydroelectric plants.

A similar situation could exist between El Salvador and Honduras for integration of the Rio Lempa plants and the Rio Lindo plants. In this case the combined El Salvador-Honduras system loads would be met in the wet season with the Rio Lempa plants operating at a high load factor and with the Rio Lindo plants used for peaking only. Less water would be released from Lake Yojoa during the wet season than would be the case if Rio Lindo plants were to serve Honduran loads independently. Then, in the dry season the combined system loads would be met with Rio Lindo operating at higher load factor and Rio Lempa plants used for peaking.

In both examples net annual energy interchange could be balanced. During peak demand hours no interchange would occur, each country's peak

loads being served by the nation's own power plants.

The value of such interchange is further enhanced by any diversity of hydrologic cycles. For example, the critical dry year on the Rio Lempa may not coincide with the critical dry year at Lake Yojoa. The two systems together would have a higher firm energy output than the sum of the two systems taken separately.

Integration on an energy interchange basis places the minimum of reliance of each system upon the other. Short duration interruption of transmission interconnection would not cause immediate curtailment of power supply to either country.

Interchange of Capacity

On-peak interchange of power, or capacity, is possible if two countries have any diversity in the time of maximum peak demands, either seasonably or daily, or a diversity in maximum power plant peaking capability.

Throughout Central America the social and industrial patterns are very similar, and the annual streamflow cycle is also similar. The opportunities for capacity interchange are not, therefore, as prevalent. There are presently some differences which could be exploited. Lately the peak load on the CEL system has ocurred in February-March, while peak demands in Tegucigalpa have occurred in December. The combined peak might be significantly less than the sum of the individual peaks, in which case interchange of on-peak power might be advantageous.

Diversity of generating capability would occur if the kilowatt output of one country were reduced due to drawdown of reservoirs at a different time than in a neighboring country. We do not know of such a situation existing, but it is possible that diversity might occur between Atlantic slope plants and Pacific slope plants.

Direct sale of energy

Interconnection between countries will allow direct sales of energy over and above any balanced interchange. Long term arrangements for direct sale of energy would probably be possible in cases where the exporting country has a continuing surplus of energy in the wet season and the importing country has a sizeable thermal system.

Short term arrangements would be possible between any two countries immediately following the construction of a large new power plant, with energy, withdrawn from sale as the output of the new plant is needed within the exporting country. Under such short-term withdrawal contracts neighboring countries could coordinate their construction programs, alternate new installations, and build larger, more economical, powerplants.

Direct sale of power

The conditions for direct sale of power on long term arrangements would exist only if the cost of new plants were materially less in one country than in another. In this case, the country having high cost projects might obtain power and energy at less cost by purchase from a neighboring

country than would be possible with national generation.

Short term arrangements for direct sale of power could be made under the same conditions as short term sale of energy to equal advantage.

Sharing of reserve capacity

Most Central America countries cannot at present afford to carry substantial reserve capacity. This situation will undoubtedly change as system loads grow and customers come to demand higher standards of reliability. When the need for reserve capacity arises, interconnection between countries will permit a degree of sharing in reserve capacity which should result in savings to the combined systems. Where individual systems might need ten percent reserves, the combined system might need only five percent. Diversity of peak loads and the improbability of simultaneous autages in the larger combined system would give equal reliability with smaller margin of reserve. Planned maintenance of plants can be coordinated within the system to eliminate interruption in service.

Even though partial or complete interconnection of Central America may not come into being for a number of years, electric power planning should recongnize the future possibility. Agreement should be reached between the individual countries on matters of voltages and frequencies. Insofar as is feasible, transmission lines within each country should be located and designed to conform with an ultimate interconnecting grid. In view of the total distance involved, grid voltage might eventually have

to be in the 230 - 400 KV range.

A coordinating committee could well be established to interchange information on power expansion plans and to discuss the effect of each nation's system upon future integration. Small scale experiments in international sale of power should be incouraged in suitable areas along common borders.

With electric power demand in Central America doubling every five to seven years, the need for new generating capacity will become increasingly large. The time will most certainly come when some or all forms of integration described herein will be to the best interests of Central America.